U.S. FOREST SERVICE

NORTHERN REGION

DIVISION OF STATE AND PRIVATE FORESTRY

INSECT AND DISEASE REPORT

Report No. 71-33

5230
November 1971

FORECASTING LARCH CASEBEARER DEFOLIATION IN THE NORTHERN REGION--PROGRESS REPORT

by

W. M. Ciesla and W. E. Bousfield
Entomologists, Forest Insect and Disease Branch

The larch casebearer, Coleophora laricella (Hbn.), has been known to occur in western larch forests of the Northern Region since 1957. Repeated heavy defoliation by casebearer larvae causes growth loss, branch dieback, and some tree mortality. During December 1970, work was begun to develop a method of forecasting defoliation potential based on systematic counts of overwintering casebearer larvae. These data would provide valuable information upon which to (1) forecast Region-wide and Forest-wide population trends, or defoliation potential and population levels in sites proposed for operational control projects, (2) select test sites for field experiments of promising chemicals to suppress casebearer infestations, and (3) select sites for future parasite releases.

METHODS

Sampling the overwintering stage.--A series of 64 sample plots consisting of 10 western larch each 30 to 60 feet in height, were established in casebearer infested stands throughout northern Idaho, western Montana, and northeastern Washington. Four branch samples approximately 15 inches long were removed from each sample tree with a pole pruner. Each tree was numbered and tagged for future reference.

One hundred spur shoots were examined on each branch sample in the laboratory and the number of overwintering larvae attached to each spur shoot was counted. Data for each plot was expressed as the number of overwintering larvae per 100 spur shoots.

Rating defoliation.--Sample plots were examined in late May and early June when defoliation was at its maximum. The crown of each sample tree was divided into three equal levels--upper, mid, and lower. Each crown level was given a numerical defoliation rating as follows:

0 - Negligible--no visible defoliation or discoloration

2 - Light --up to 25 percent of the foliage discolored

4 - Moderate --25 to 50 percent of the foliage discolored

6 - Heavy --50 to 75 percent of the foliage discolored

10 - Severe --over 75 percent of the foliage discolored

Crown levels were weighted roughly in proportion to the amount of foliage: 1 for upper crown, 3 for midcrown, and 5 for lower crown. Crown level and defoliation were combined in a matrix which established a defoliation index for each crown level (Table 1). The sum of the indexes for the three crown levels was the tree rating. The defoliation index for the plot was the mean of the 10 tree ratings. A linear regression line ($y = mx + b$) was computed from these data where x = the number of overwintering casebearers per 100 spur shoots and y = the corresponding defoliation index for that plot.

Table 1.--Matrix used to compute larch casebearer defoliation index for three crown levels on sample trees.

	Intensity of defoliation				
Crown level	Negligible (0)	Light (2)	Moderate (4)	Heavy (6)	Severe (10)
Upper (1)	0	2	4	6	10
Mid (3)	0	6	12	18	30
Lower (5)	0	10	20	30	50

RESULTS AND DISCUSSION

The 64 sample plots provided the desired broad spectrum of infestation levels ranging from 0.075 overwintering larvae per 100 spur shoots at Thompson Falls, Lolo National Forest, Montana, to 209.9 larvae per 100 spur shoots at Elk River, St. Joe National Forest, Idaho. The mean number of larvae per 100 spur shoots was 55.13 for all 64 plots. Similarly, there was a broad range of defoliation indexes ranging from 0 (negligible defoliation) at several Montana locations where no damage was apparent to 77.6 (severe) at the Elk River plot.

The linear regression line $y = .290979x + 6.818$ was computed for the existing data (Fig. 1, Table 2). This regression was significant at the 99 percent level at 1 and 63 degrees of freedom with an F value of 214.494 due to regression. The correlation coefficient (r) was 0.881 which indicates that there is a strong relationship between numbers of larvae per 100 spur shoots and defoliation. Therefore, the number of overwintering larvae should provide an acceptable forecast of the degree of defoliation which can be expected.

A broad prediction of larch casebearer infestation was made on the basis of population densities measured during the winter of 1970-71. (Ciesla and Bousfield 1971)[1/]. This prediction stated that heaviest defoliation would occur in Idaho in 1971 with light defoliation occuring throughout Montana except the vicinity of Flathead Lake where damage would be conspicuous. This forecast generally held true for the spring of 1971.

Additional overwintering larvae counts will be made during the winter of 1971-72 to test the accuracy of this prediction equation.

1/ Ciesla, W. M. and W. E. Bousfield. Potential for defoliation of western larch by larch casebearer in the Northern Region -- 1971. USDA - Forest Service, Division of State and Private Forestry, Forest Insect and Disease Report 71-3, 1971.

Table 2.--Tabular value of the larch casebearer defoliation prediction equation.

(y = .290979 x + 6.818 with 95 percent confidence intervals)

Casebearer larvae per 100 spur shoots (x)	Defoliation index (y)	95% confidence intervals		Predicted defoliation
		Lower	Upper	
0	6.818	4.34617	9.28983	negligible to
5	8.27289	5.87854	10.6673	light
10	9.72779	7.40578	12.0498	
15	11.1827	8.92739	13.438	
20	12.6376	10.4429	14.8323	
25	14.0925	11.9517	16.2333	
30	15.5474	13.4533	17.6414	
35	17.0023	14.9473	19.0573	
40	18.4572	16.4331	20.4812	
45	19.9121	17.9105	21.9136	
50	21.367	19.3791	23.3548	
55	22.8218	20.8387	24.805	
60	24.2767	22.2893	26.2641	light
65	25.7316	23.731	27.7323	light
70	27.1865	25.1639	29.2092	to
75	28.6414	26.5882	30.6946	moderate
80	30.0963	28.0045	32.1882	
85	31.5512	29.413	33.6894	
90	33.0061	30.8144	35.1979	
95	34.461	32.209	36.713	
100	35.9159	33.5975	38.2343	
110	38.8257	36.358	41.2934	
115	40.2806	37.731	42.8302	
120	41.7355	39.0997	44.3713	moderate
125	43.1904	40.4646	45.9162	
130	44.6453	41.826	47.4646	moderate
135	46.1002	43.1842	49.0161	to
140	47.5551	44.5396	50.5705	heavy
145	49.01	45.8925	52.1274	
150	50.4649	47.243	53.6867	
155	51.9197	48.5914	55.2481	
160	53.3746	49.9379	56.8114	
165	54.8295	51.2827	58.3764	
170	56.2844	52.6258	59.943	
180	59.1942	55.308	63.0804	
190	62.104	57.9853	66.2227	
200	65.0138	60.6586	69.369	heavy
210	67.9236	63.3285	72.5187	
220	70.8334	65.9955	75.6713	heavy
230	73.7432	68.66	78.8264	to
240	76.653	71.3223	81.9836	severe
250	79.5628	73.9828	85.1427	severe

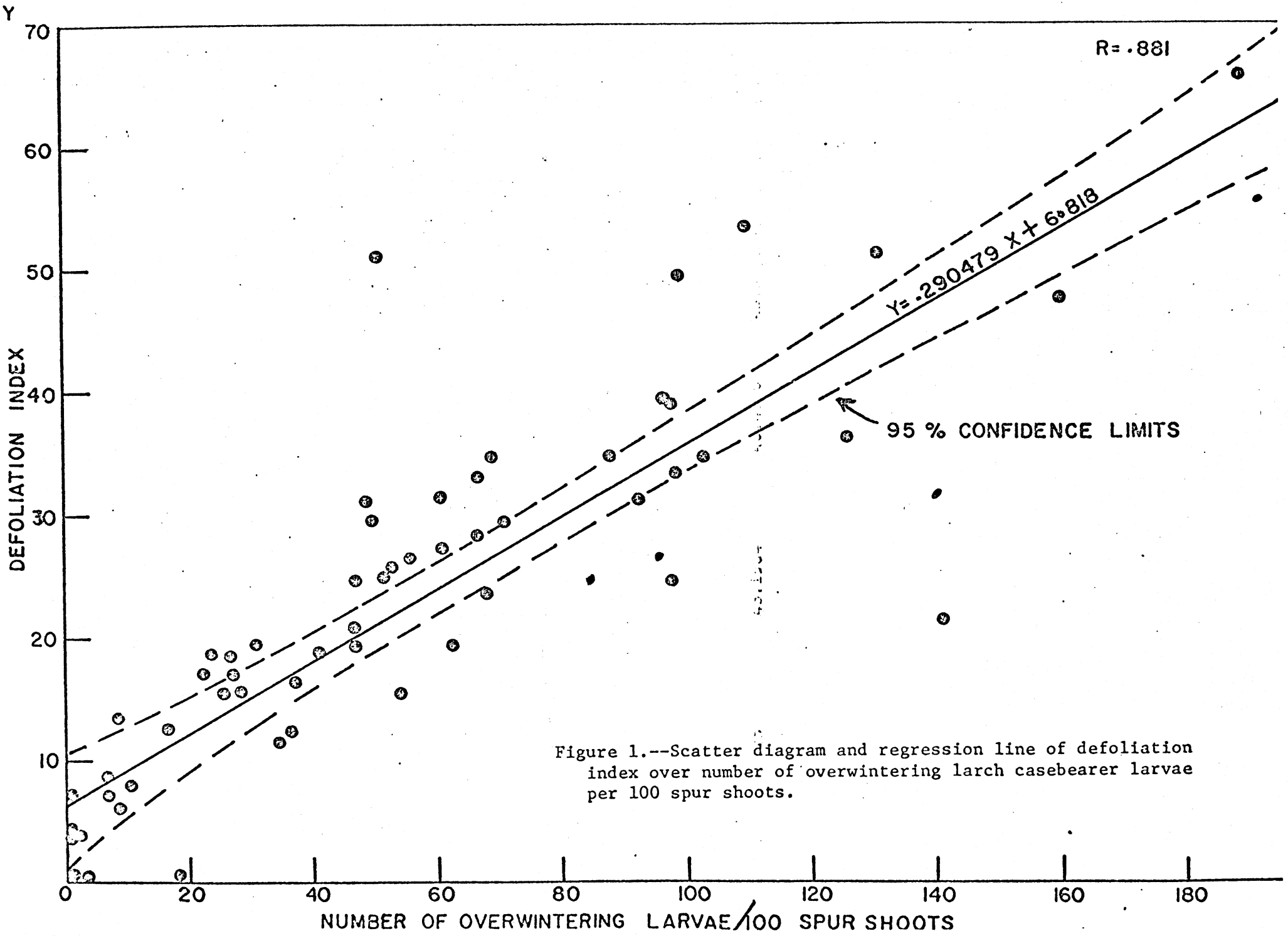

Figure 1.--Scatter diagram and regression line of defoliation index over number of overwintering larch casebearer larvae per 100 spur shoots.